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Paradigm shift: curatorial views on collecting and archiving architectural drawings in an evolving born-digital landscape

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Paper presented at the Society of American Archivists Conference; Washington D.C., August 2014*

Impact of the born-digital landscape in architectural and archival practice

In architectural education, research and practice we operate increasingly in a global context. Architectural practice, and that of its allied design disciplines, has expanded and is increasingly more interdisciplinary.¹ Since the 1990s changing practices and changing technologies in the generation of architectural drawings allow firms from across the globe to work together on a project around the clock. The trend towards more complex building programs, and consequent interdisciplinary nature, where records are duplicated among designers and consultants from a range of fields, translates into an unprecedented amount of digital records. If fifty years ago construction documents for a small project were represented in a dozen drawings, today it takes ten times that many.² If we think of archival practice in relation to architectural collections, there is no doubt that collecting and archiving in the current born-digital landscape is impacted deeply in fundamental ways: the vast amount, and above all, the nature of architectural drawings has changed. Our core activities of collecting, organizing, and preserving architectural records are the subject of renewed professional attention and, given the mentioned changes, we are faced with new challenges and opportunities.³

Before discussing collecting and archiving architectural collections in this evolving landscape, I would like to briefly frame the discussion on architectural drawings within the discipline of architecture itself, and then in relation to archival science. Digital drawings are by no means an integral part of architecture's specificity as a discipline. Architecture's specificity has to do with formal, spatial, structural, and tectonic ideas and their interrelationships.⁴ The medium, whether digital or analog, has nothing to do with the specificity of the discipline. Even in contemporary architecture circles, where there may be an emphasis on computational technique because it enables greater formal control, the conceptual shift brought along with digital technology for architecture has nothing to do with the drawing per se being digital or analog. Likewise, the disciplinary specificity of archival science has nothing to do with the media of records. The specificity of archival science has to do with a core set of principles that endure: provenance and

original order, because they inform the hierarchical arrangement and description of collections that document, capture, and explain contextual relationships, no matter what media records present themselves in. However, within a born-digital landscape we do have a significant shift: an analog architectural drawing *is* the record's intrinsic content, whereas in a digital drawing the content always needs an environment (made up of software, hardware, and computer files) to render it. Because these environments are many times proprietary and dynamic (that is to say they keep evolving and changing) they bring along the problem of digital continuity.⁵ This is the paradigm shift: it has to do with the process by which, and context within which, the records that document architectural practice are created. What is significant for us is how this shift opens up new ways of thinking about archival practice.

To collect, describe, and preserve architectural drawings produced with programs such as CATIA, Rhino, Maya, Revit, and AutoCAD, we need to understand their nature because this informs us why we cannot preserve the records in the way we would instinctively want. The "Preservation Handbook for Computer Aided Design"⁶ explains that in CAD a drawing is defined as a collection of objects and coordinates, where the object definitions are stored internally in a database.⁷ The software plots the drawing from those coordinates and object definitions to a computer screen or directly to a printer or plotter. Additionally, most CAD packages also support 3D modeling as both wireframe (which is a skeletal geometry) and as solid models (where faces or surfaces depict the model as a solid object). The 2008 technical report "An Overview of 3D Data Content, File Formats and Viewers"⁸ has in-depth information that helps understand the difficulties of 3D file format conversions.⁹ It describes 3D modeling in terms of three categories: geometry, appearance, and scene information. Probably the easiest to understand for most of us is the one they describe as "geometry". It refers to models that are stored as 3D points or vertices, and the surface thus generated as a series of polygons or faces. However, if smooth surfaces are to be rendered on a curve at any scale, then the surfaces are defined as a set of a few control points and a set of parameters. When the modeling is done through constructive solid geometry (by adding or subtracting volumes from one another) an exact solid is stored, as opposed to a sampled version of vertices, edges, and faces. The difficulty is in the conversion from one type of 3D definition to another, and it results in errors such as: "missing, collapsed, or inverted faces;

models that do not form closed solids; lines that do not meet at corners; lines that cross at corners; surfaces that do not meet at lines; planar surfaces drawn out of plane,”¹⁰ and so on.

The late Bill Mitchell, of MIT’s Media Lab had forecasted back in the 1990s that not only with CAD, but with computer aided manufacturing technology (where you can fabricate pieces of a building directly from a 3D CAD model), a very radical step would take place: traditional working drawings would literally be eliminated and records of such processes for future scholars would be irretrievably lost.¹¹ Landscape architects at ETH in Zurich are already exploring how to model exterior landscape scenes with point cloud technology. They do this through laser scanners that measure 3D coordinates of millions of points in a short time, sometimes with RGB values for each point.¹² They map, visualize and model landscapes with great precision. These new horizons that architects and landscape architects increasingly conquer continue to impact how we think about collecting and archiving the records of such practice. Until about twenty years ago architects remained skeptical of keeping architectural drawings solely in digital, and were consistently making paper copies. This was indeed the cautionary message architectural archivists were sharing with the design community. However, twenty years later, we share the inevitability of being immersed in a digital world, and many of us are already arguing that the digital *is* the original, not the printout record copy. We need more sophistication in the knowledge of how digitally-based drawings are generated to better understand their possibility, or not, of long-term preservation.¹³

To this end, the archival community has already carried out a series of studies and initiatives that provide a good foundation to understand the problem.¹⁴ We are developing frameworks that take into account the organizational, financial and technological aspects of the context where preservation needs to take place, and are considering the life-cycle of digital records. The OAIS Reference Model¹⁵ is one good example of this, where we are understanding the need of workflows and the difference between submission, archival, and dissemination packages. In fact this has been extremely useful for us at the GSD in planning for the preservation of born-digital theses submitted by students of all academic departments. The archival community is also developing tools, although still in very preliminary stages, where archival arrangement and description is scalable to large quantities of files; and we are striving to consolidate trusted digital

repositories.¹⁶ In the best of cases, if we are the archivist in an architectural office, or in a repository receiving drawings related to an institution's property information and construction activity, we can develop required submission standards related to general file format, file setup, layering, and naming conventions to be complied with at the originating office. These require, for example, that each file be a single drawing with one title-block and be model space only (not paper space), that blocks be created and/or inserted in layer 0, or that they revert to 0 when exploded, and that external references be inserted and retained as a block within each single drawing to produce a self-contained drawing file. In addition, we may also require submission in archival pdf format (at the GSD we are currently requiring PDF-A1b), because to this day it is the best long-term approach for the preservation of digital architectural drawings¹⁷. However, these are ideal conditions. For many of us, who receive architectural records as part of collections, not at the completion of a construction process but years after the building has been long built, the born-digital landscape is indeed quite more complex because we have no say in the process by which these drawings were generated and or maintained in their offices of origin.

Challenges of collecting and archiving in a born-digital landscape

The born-digital landscape raises curatorial, technological, and long-term preservation challenges for architectural archivists that need to be considered jointly. In the book *Conceptualizing 21st Century Archives*¹⁸ Anne Gilliland expresses that "archivists should seek to contribute more to the world than simply trying to stay afloat in a sea of change." From a curatorial perspective this emphasizes the need to keep long-term considerations in mind during the key activities of collecting, organizing, and preserving architectural collections. I'm understanding here the archivists' curatorial role in the broadest sense: as enablers of knowledge, rather than keepers of knowledge¹⁹. We are all active agents in this process of enabling knowledge by building collections, establishing connections within and between collections, surrounding a work with a network of data and contextual information, in sum a series of actions that enable a constellation of new interpretations and ideas to be constructed. Within this framework, if we think strategically for the long-run our professional attention is centered on collecting and archiving.²⁰ Terry Cook has noted that over the past 150 years the archival identity has been shifting across different frameworks or mindsets, and that archivists have moved from passive recipients and

custodians to “proactive appraisers, societal mediators, and community facilitators”.²¹ As opposed to thinking about collections and archives, he suggests putting the emphasis on the act of collecting and archiving, which assumes an active role on our part. As curators in an evolving born-digital landscape we now face new challenges and real dilemmas.

In terms of collecting architectural digital files one challenge refers directly to the most obvious one, and that is collecting records in relation to their life-cycle. The nature of architectural digital files clearly indicates that they need to be collected and captured at, or near, creation. The difficulty is that for many collecting cultural institutions architects have generally come to us near the end of their careers, when they want to transfer the totality of their files to a repository. In a born-digital landscape this is nowhere close to the moment of creation of those files.

Furthermore, on the other side of the spectrum -when careers are beginning- architects are not at the point where they know where they want their records to ultimately go, they have no idea what the long-term view of their work will be, and rightly so this is not even in their minds.

Therefore, when to collect, in practical terms, is a real challenge. Another challenge is the legal challenge of the acquisition of files. In the United States, many owner-generated agreements with architects contain a provision that vests the client with the ownership of the architect’s drawings and specifications.²² This means that many architects do not actually hold ownership, nor copyright, of their files, which adds yet another dimension to the legal availability of their files for collecting.²³ The feasibility of a deed of gift, which is the legal instrument by which many of us as archivists and curators have mostly acquired an architect’s drawings, is almost impossible if expecting to acquire files near their point of creation. This has brought along the consideration of non-exclusive license agreements, and sometimes embargos on a considerable amount of files, in lieu of deeds of gift, as a possible legal instrument for acquiring digital files from architects.²⁴

A third challenge for collecting in a born-digital landscape has to do with appraisal and uniqueness of collections. Appraisal is crucial not only given the massive amounts of digital files generated in architectural practice, but above all when one takes into account the traditional sense of an original vis-à-vis the ease of reproducibility of digital files. If we are to acquire digital files through non-exclusive license agreements, then our donors retain the right to provide those same files to others in the future. Therefore, will we be moving away from uniqueness of

collections (in terms of exclusivity of files) towards a shift where other parameters will be the drivers of collection strength? What will those parameters look like? It is well known, as indicated in the CLIR Report entitled *Enduring Paradigm...*, that “digital technology is creating and information landscape characterized by fluid boundaries.”²⁵ The non-exclusivity of files may well be a boundary to pay close attention to. The notion of “the original” in a digital landscape has already been a point of contention. In *Authenticity in a Digital Environment*²⁶ Abby Smith asks “Does the concept of an original have meaning in the digital environment?” In the same issue Clifford Lynch explains that “in the analog world, I give you the object and now you have it and I do not. In the digital world, I share with you a file that has the same properties as the file I have—the original, as it were. Now I have it, and you have it, too.”²⁷ What is important is that both are authentic files, even if not strictly the original. So if exclusivity of files will not be at play in a digital landscape, will uniqueness of collections be what we should be focusing on? Will uniqueness be given by the files themselves (we may be duplicating the exact collection someone else has) or will uniqueness be given by the added value we provide in terms of contextual information? Maybe the strength of an institution’s collection will not be in files kept in isolated silos, but in the context within which those files are described and made accessible. Carole Palmer in “Beyond Size and Search” predicts collections will become “anchors for meaningful engagement with digital information.”²⁸ For this to happen digital objects need to be collected, described and preserved with us as active agents in that context creation. This brings me to the topic of archiving, both in terms of preservation and access.

In terms of archiving architectural digital files we also have several challenges. As active agents in the process of collecting, organizing, and preserving digital architectural drawings there are a myriad of long-term preservation considerations. Archiving digital architectural drawings necessarily entails digital or data curation, and by this I mean the active and ongoing management of data throughout its lifecycle. This is necessary (and again the OAIS Reference Model is an excellent framework to follow) so that the intellectual and digital integrity of records is maintained and so that individual digital objects are correctly contextualized and referenced to one another. Digital curation encompasses both digital preservation and other activities necessary for the dissemination and use of digital content.²⁹ As curators of collections we write collection descriptions, detail scope and content, establish a hierarchical arrangement, describe

contents both physically and intellectually, and carry out preservation strategies depending on the media and support of drawings. With born-digital architectural collection all of this is still true. Most probably what will become increasingly significant are tools for the capture and description of content and context, both at the collection level and at levels of further granularity, particularly if we are to provide online access to individual architectural drawings. Metadata (descriptive, administrative and structural) is critical³⁰, particularly in a global landscape where information is increasingly distributed and researchers already expect access through digital means. Discoverability in what will surely become aggregated collections will depend on the contextual information we provide. Carole Palmer, refers to this as “contextual mass”:

Contextual mass is the necessary core “in order to produce dense, rich, and cohesive groupings of sources for research and analysis” and that it “enables aggregations that will become hubs that successfully connect the researcher with the originating context of a collection.”³¹ Context is always relational. Individual digital objects, if they are to be useful, need to be understood within their context rather than as separate, individual, stand-alone items. Our role here as active agents in archiving architectural digital objects becomes evident. Contextual mass will enable broader access which fosters and advances architectural scholarship, and is essential to keep in mind when developing tools and trusted digital repositories.

Lastly, raise awareness and advocate. It is important for us to recognize that architects and archivists alone cannot deal with the issue of long-term preservation of digital files. For both of us it is beyond our professional knowledge and expertise. Some questions can only be addressed with the participation of technologists or software developers and programmers who have deep expertise in how systems operate. There is also the need of large investments in technology, and together (deep expertise and large investments) seem to point towards collaborations across disciplines and, many times, across institutions. As advocates for collecting and archiving digital architectural drawings it is important that we search for consensus, in the architectural communities we are each involved with, so that architects understand the real need for them to also address the long-term future of their own drawings in an informed manner. This can be done within architectural offices by advocating for the reading, understanding, and implementation of standards³², and by archivists collaborating with architects so that they actively and jointly support collecting and archiving strategies. Even if initially it may only be incorporating the

creation of archival pdf files at the closing of a project as part of architects' workflow, this is an important step forward.³³ Ideally, architects could also become advocates for long-term preservation through their professional associations. These will have more leverage with software companies that cater to their industry if long-term preservation is raised as a widespread and common concern. As producers and enablers of architectural digital collections we face the inevitability of navigating this evolving born-digital landscape. It offers us the opportunity to collaborate, which in turn fosters new thinking and good practices related to collecting and archiving digital architectural drawings.

¹ In *Reflections on Architectural Practices in the United States in the Nineties*, Peter Rowe, the former dean of Harvard University's Graduate School of Design, argues that there is evidence that the architecture profession is changing, and among the many drastic changes, he recognizes the "increasingly interdisciplinary nature it has recently acquired, and the changes in size, type and scope of architectural practices."

² Olsberg, Nicholas, "Documenting Twentieth-Century Architecture: Crisis and Opportunity", *The American Archivist: Special Edition on Architecture*, Vol. 59, Spring 1996: "Only back in the 1940's an architect could present a full drawing set for a single house in one sheet, while by the 1980's the drawings for a single project - the Centre Georges Pompidou in Paris - numbered 200,000 drawings."

³ In terms of collecting, given the ease of reproducibility of digital files, the notion of uniqueness of collections can certainly be brought into question. In terms of organizing, given the vast amount of digital files, we now reconsider arrangement and description in relation to scalability. In terms of preservation of digital files given the dynamic nature of digital architectural drawings we are confronted with a technological nightmare that, as architectural archivists, requires that we collaborate with technologists and digital preservation specialists.

⁴ For more on this subject, see Sherer, Daniel: "The Architectural Project and the Historical Project: Tensions, Analogies, Discontinuities", in *Log* No. 31, Spring/Summer 2014.

⁵ For more on the topic of "digital continuity", see Becker, Christopher, et al. "Systematic planning for digital preservation: evaluating potential strategies and building preservation plans", in *International Journal on Digital Libraries*, December 2009.

⁶ "Preservation Handbook, Computer Aided Design (CAD)" produced by the Arts and Humanities Data Service and the Joint Information Systems Committee of the UK, 2005.

⁷ Ibid. The handbook provides good practice guidance for repositories collecting CAD materials. It also explains the difference between bitmap graphics and CAD, which is the environment in which most architectural drawings are currently created. In bitmap graphics the encoding of an image is through specific pixel values in a raster; while CAD relies on data stored in a database.

⁸ "An Overview of 3D Data Content, File Formats and Viewers", produced by the Image Spatial Data Analysis Group of the University of Illinois at Urbana-Champaign in 2008.

⁹ Ibid. The report identifies no less than 140 different 3D file formats used in a diversity of applications. The different applications are for medicine, architecture, structural engineering, automobile industry, the military and so forth.

¹⁰ Ibid.

¹¹ Mitchell, William, "New Digital Technologies in Architecture and their Implications for Architectural Records", *Blueprints to Bytes: Electronic Records in the Electronic Age*, Massachusetts Committee for the Preservation of Architectural Records, Boston, 2000.

¹² The visualizations and animations of the LVML research team under the direction of Christophe Girot from ETH Zurich will be published in "Landscape, Myths and Technology", forthcoming.

¹³ If the native digital file is the original, and certain file types cannot be preserved in their original format, maybe the practice of producing archival pdf files for each drawing is not such an outrageous idea for architectural offices to implement as part of their workflow when a project closes.

¹⁴ See *Bibliography on studies dealing with legal, technical, and curatorial issues related to born-digital architectural records* (prepared by Aliza Leventhal and Inés Zaldueño, Society of American Archivists, CAD/BIM Taskforce, Blizzard 2013). This annotated bibliography lists, among others, the following studies and initiatives: 1. "GAU:DI (Governance, Architecture, and Urbanism: a Democratic Interaction)" by the EU; 2. "Collecting, Archiving, and Exhibiting Digital Design Data" by the Arts Institute of Chicago; 3. "Preservation Handbook, Computer Aided Design (CAD)" by the Arts and Humanities Data Service and the Joint Information Systems Committee, both of the UK; 4. "International Organization for Standardization (ISO 82045-5:2005 / IEC 82045)" by the international federation of national standards bodies; 5. "FACADE, Future-proofing Architectural Computer-Aided

DEsign” by MIT (and “FACADE2”, a joint study between MIT and Harvard’s Frances Loeb Library); 6. “An Overview of 3D Data Content, File Formats and Viewers” by the Image Spatial Data Analysis Group of the University of Illinois at Urbana-Champaign; 7. “Designed to Last: Preserving Computer Aided Design”, a conference by the British Library’s Centre for Conservation sponsored by the Digital Preservation Coalition; 8. “Geospatial Multistate Archive and Preservation Partnership (GeoMAPP)”, a partnership between the Library of Congress of the United States, and state geospatial units and archives from North Carolina, Montana, Kentucky, and Utah; 9. “Sustainability of Digital Formats: Planning for Library of Congress Collections”, a source hosted by the Library of Congress; 10. “DuraArk, Durable Architectural Knowledge”, a project funded by the European Union started in 2013 with the participation of several universities and architecture centers within Europe. The bibliography also mentions the Digital Preservation Coalition’s (DPC) Technology Watch Reports: “Preserving Computer-Aided Design (CAD)”, written by Alex Ball.

¹⁵ OAIS (*Open Archival Information System*) is an International Organization for Standardization standard (ISO 14721) first published in January 2002, and, at the time of this writing, superseded by the June 2012 version.

¹⁶ However, we need to make note that in this evolving born-digital landscape we share with the design and technology communities the fact that we are all newcomers to a foreign land and, as both “digital natives” and “digital immigrants”, we have not yet figured out how to navigate it completely. (For distinctions between digital natives and digital immigrants, see *Born Digital: Understanding the First Generation of Digital Natives* by John Palfrey and Urs Gasser).

¹⁷ CAD is particularly not conducive to long-term preservation, however STEP (Standard for the Exchange of Product Data) is an ASCII-based ISO standard (ISO-10303) that may prove in the long-run to be suitable for preservation.

¹⁸ Gilliland, Anne J. *Conceptualizing 21st Century Archives*. SAA: Chicago, 2014.

¹⁹ As I understand it, as curators of collections, we are participants in a process where the future will be constructed out of the records of the past, and as such have agency in this process.

²⁰ I am also understanding archiving here as encompassing both preservation and access.

²¹ Cook, Terry. “Evidence, memory, identity, and community: four shifting archival paradigms” in *Archival Science*, June 2013, Volume 13, Issue 2-3.

²² Generally, the decision to transfer ownership to their clients is a business decision.

²³ This is also, by the way, why some institutional archives, if hiring architects for the design and construction of their own buildings, can currently dictate submission requirements for digital files.

²⁴ Embargos obviously pose issues of immediate access, but if we have in mind the long-run this may well be a very feasible solution in how to collect architects’ work.

²⁵ Gilliland-Swetland, Anne J. “Enduring Paradigm, New Opportunities: The Value of the Archival Perspective in the Digital Environment.” Council on Library and Information Resources (CLIR), Report 89, February 2000.

²⁶ Smith, Abby. “Authenticity in Perspective,” in *Authenticity in a Digital Environment*: Council on Library and Information Resources (CLIR) Report 92, May 2000.

²⁷ Lynch, Clifford. “Authenticity and Integrity in the Digital Environment: An Exploratory Analysis of the Central Role of Trust,” in *Authenticity in a Digital Environment*: Council on Library and Information Resources (CLIR) Report 92, May 2000.

²⁸ Palmer, Carole L., et al. “Beyond Size and Search: Building Contextual Mass in Digital Aggregations for Scholarly Use.” ASIST 2010, Pittsburgh, PA.

²⁹ For further understanding of “digital curation”, see Gilliland, Anne J. *Conceptualizing 21st Century Archives*. SAA: Chicago, 2014.

³⁰ See “A Framework of Guidance for Building Good Digital Collections.” National Information Standards Organization (NISO). Baltimore, MD, 2007.

³¹ Palmer, Carole L., et al. “Beyond Size and Search: Building Contextual Mass in Digital Aggregations for Scholarly Use.” ASIST 2010, Pittsburgh, PA.

³² In addition, the UK’s “Preservation Handbook, Computer Aided Design (CAD)” suggests that STEP (Standard for the Exchange of Product Data) may prove to be suitable for preservation. Versions of AutoCAD 2002 onwards enable translation to and from STEP, an ASCII-based ISO standard (ISO-10303).

³³ See recommendations of “Collecting, Archiving, and Exhibiting Digital Design Data” by the Art Institute of Chicago, 2003; and of “FACADE, Future-proofing Architectural Computer-Aided Design” by the MIT Libraries together with the School of Architecture and Planning of MIT, 2009.